

Technical & Financial Feasibility Study for Installation of Solar Panels at IDOT Owned Facilities (ICT R27-207)

October 28, 2021



SEDAC

SMART ENERGY DESIGN ASSISTANCE CENTER

Providing effective energy strategies for buildings and communities

Project Objectives and Tasks

	Objectives	Tasks
1	Determine whether solar development is administratively feasible, considering procurement and solar siting on IDOT properties.	Identify applicable laws that could affect procurement, project development, and use of IDOT facilities and right-of-ways as host sites for solar systems.
2	Determine whether solar on IDOT properties is technically and economically feasible.	Evaluate and prioritize IDOT-owned assets for solar production potential, and develop cost-benefit estimates at a variety of specific IDOT sites.
3	Provide guidance on site selection for future solar projects.	Develop a user-friendly decision-support tool to assess technical and financial feasibility of solar systems in any IDOT property.
4	Develop an overall strategy for moving forward with solar project development at IDOT.	Create a final report that summarizes research findings and recommendations.

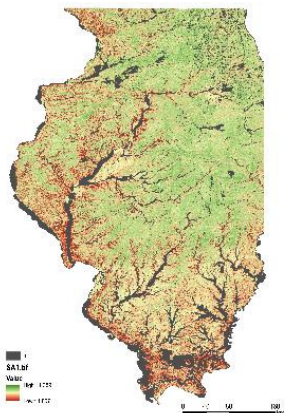
Task 1 Administrative Feasibility

- IDOT is permitted to install solar, including 25-year PPA contracts*
- Safety, access, FHWA
 - Roof top solar – ok
 - Some ROW – ok ? large areas away from roadside; controlled interchange areas; some grounds areas around yards and rest areas
- Utility interconnection
 - ComEd, Ameren, MidAmerican – ok
 - Rural coops – ok, but size limitations
 - Municipal electric companies – some don't allow net metering
- Procurement rules make it hard to get good pricing info before RFP

*In 30 ILCS 500/25-47, "Renewable energy resources contracts or leases," Illinois state agencies are specifically allowed to procure renewable energy in contracts of up to 25 years in duration, as in a power purchase agreement.

Task 2 Technical & Economic Feasibility

Site selection and narrowing for case study



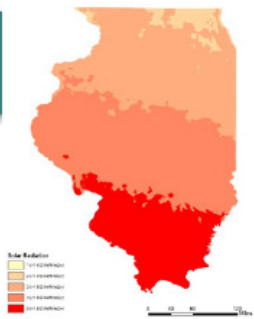
Quantitative Analysis of ~350 IDOT sites:
GIS based analysis tool pre-screened IDOT large sites, plus
manual review of small sites to select top sites



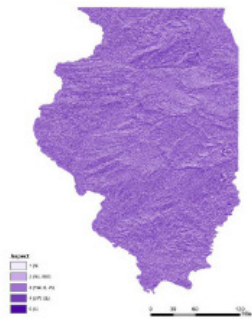
Qualitative Analysis:

Facilitated review process to vet identified sites
Narrowed to short list of ~40 sites for district review
5 case study sites selected

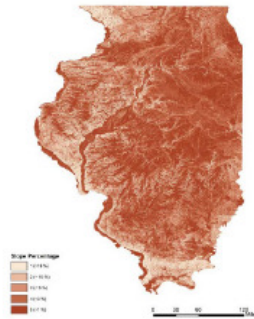




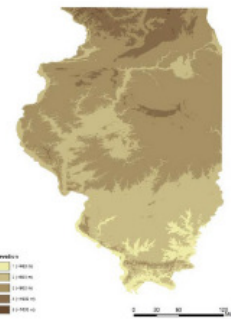
Solar Radiation



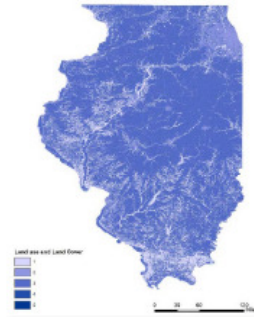
Aspect



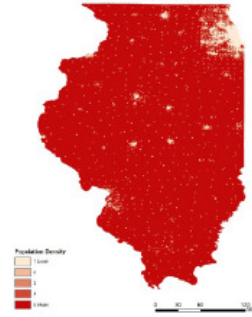
Slope Percentage



Elevation



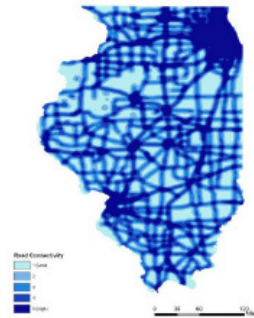
Land Use/Land Cover



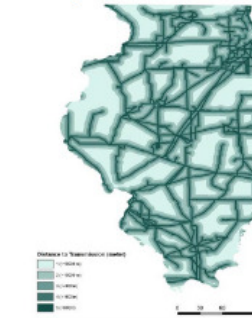
Population Density

Approach

- Statewide 30mx30m weighted solar suitability score using 9 criteria



Road Connectivity



Distance to Transmission Lines



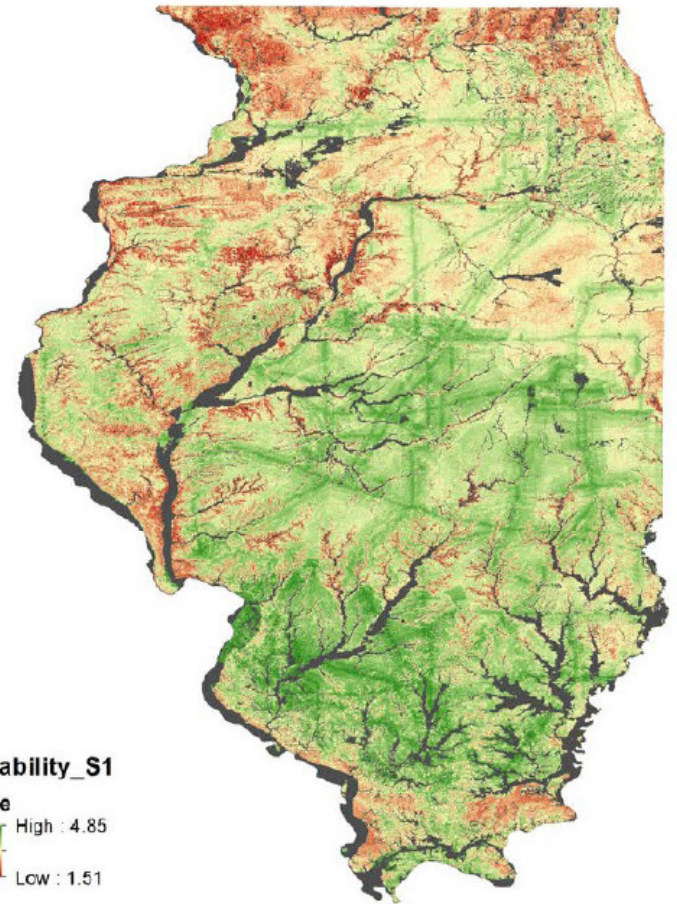
Tree Canopy %

Suitability_S1

Value

High : 4.85
Low : 1.51

Constraint



0 30 60 120 Miles

Suitability Screening Tool

Multi-Criteria Decision Analysis – Tool Development Details

$$S_k = \sum_{j=1} C_{jk} W_j E_k$$

Weighting based on relative importance of criterion. Cells in exclusion criteria given value of 0.

Evaluation Criteria

Category	Criteria	Weight
Environmental	Solar radiation	33.3%
	Slope percentage	17.5%
	Aspect	4.8%
	Elevation	5.1%
Social	Land use & cover	10.9%
	Population density	2.5%
Economic	Road network access	4.5%
	Distance to Transmission	13.3%
	Tree Canopy	8.2%

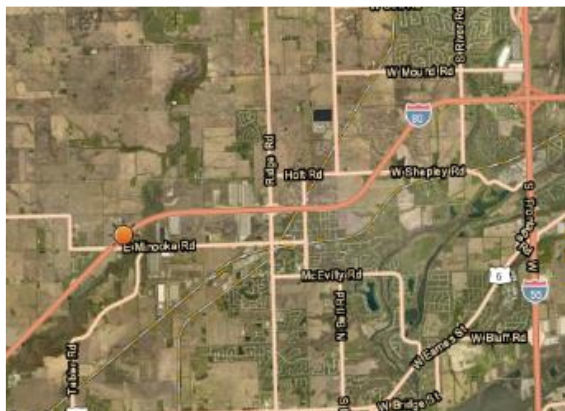
Exclusion Criteria

- 1) Water bodies
- 2) 100-year floodplain
- 3) Illinois Protected areas

Site 1 Large Parcel – District 3

IDOT solar farm covering most of the ROW

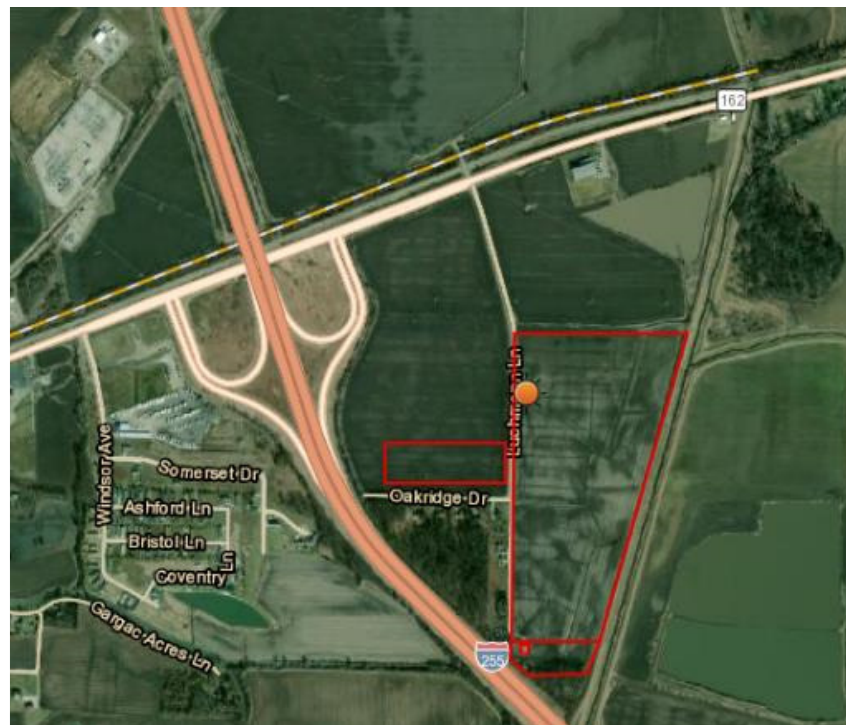
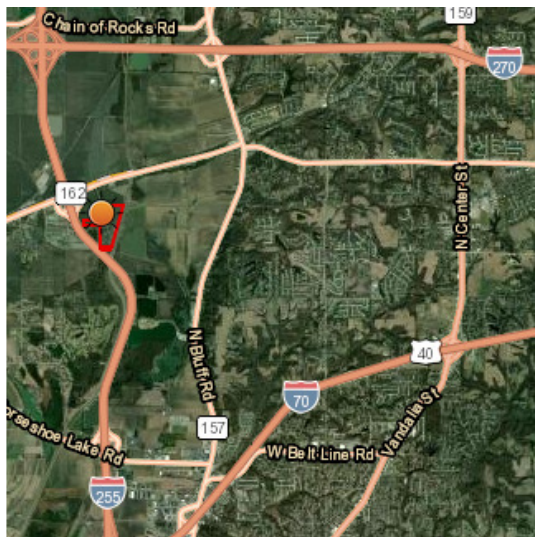
Site	Solar Type	District	Location	Site Area	Prelim. Est. Solar Info	Utility
1	Large	3	I-80 Prairie Pkwy Corridor (Near Minooka)	120 acres	25 MW; 35,000,000 kWh/yr 150% of IDOT electric	ComEd



Site 2 Large Parcel – District 8

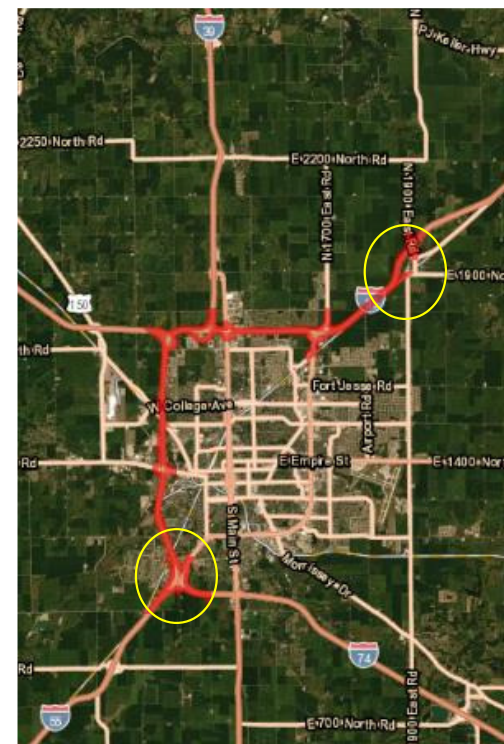
IDOT solar farm covering most of the ROW

Site	Solar Type	District	Location	Site Area	Prelim. Est. Solar Info	Utility
2	Large	8	I-255 along Cahokia Creek (Near Stallings)	68 acres	15 MW; 21,000,000 kWh/yr 90% of IDOT electric	Ameren



Site 3 ROW Corridor with Lighting & 2 Yards – District 5

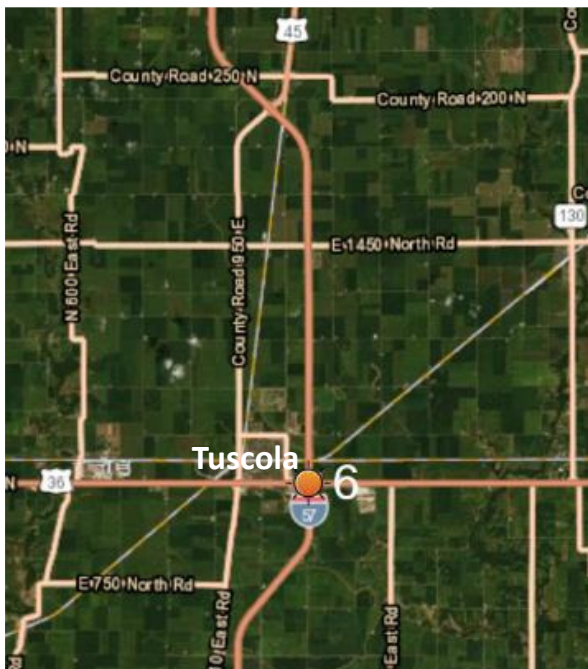
Site	District	Type	Location	Site Area	Prelim. Est. Solar Info	Utility
3	5	I-55 @ I-74 (Near Bloomington/Normal), multiple locations below				
		Lighting	Controller 111, South Interchange	TBD	4 kW (0.1 acre); 6,000 kWh/yr 100% of site electric	Ameren
		IDOT Yard	I-55 @ I-74 South Interchange	14,000 SF roof	68 kW (6800 sq.ft); 95,000 kWh/yr 100% of site electric	Ameren
		IDOT Yard	Old US-66 in Towanda	8,100 SF roof	36 kW (3600 sq.ft); 50,000 kWh/yr 100% of site electric	Ameren



Site 4 ROW, for lighting – District 5

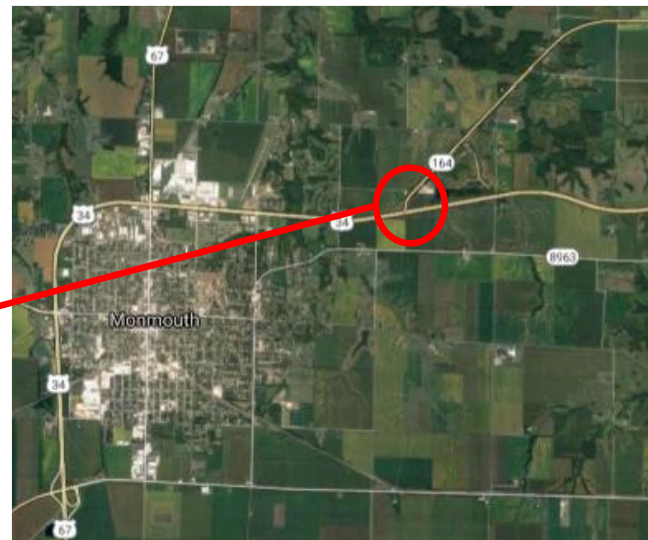
IDOT solar array sized for lighting load

Site	Solar Type	District	Location	Site Area	Prelim. Est. Solar Info	Utility
6	ROW, for Lighting	5	I-57 & US-36 (Near Tuscola) (LED)	12 acres	6 kW (700 SF); 8,000 kWh/yr	Ameren



Site 5 Off Grid, Lighting – District 4

Site	Solar Type	District	Location	Site Area	Prelim. Est. Solar Info	Utility
7	ROW, for Lighting – Off-grid w/ battery backup	4	US-34 at IL-164 east of Monmouth	9 acres	2 kW (200 SF); 3,000 kWh/yr; 100% of site electric	McDonough Power



- Marshall Metcalf, IDOT Operations – Traffic: “...the district has wanted to light this intersection but found running power to the location cost prohibitive... this is an example of some of our difficult locations where an off-grid installation might be worth analyzing.”

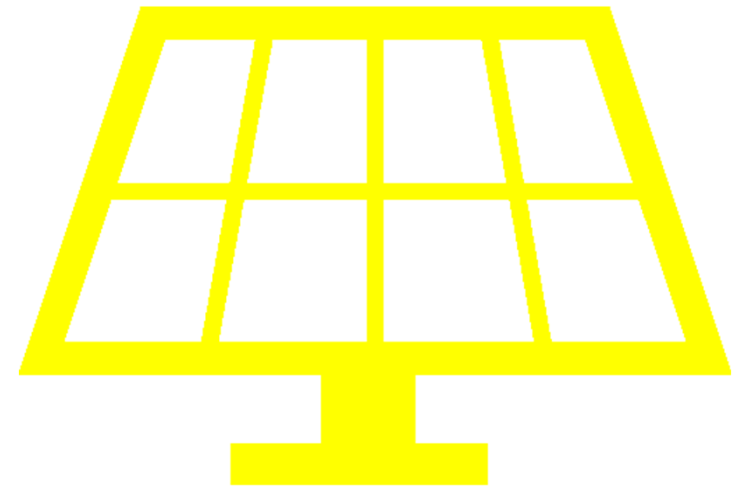
IDOT Electricity and Solar

- IDOT electricity in ComEd/Ameren: ~23 million kWh/yr
 - 1 large off-site solar procurement on one or combination of both large sites can supply all
 - Developers are interested in the large project
- IDOT electricity in other locations
 - Direct data not available, but roughly estimated at 50 million kWh/yr
 - Most of these, where solar is feasible, would be small on-site solar projects
 - Bundle groups of individual sites into procurements, for better pricing and administrative efficiency
 - Smaller projects ? Work with solar installer companies, developers less interested

Procurement Method

Power Purchase Agreement

- “A solar PPA is a financial contract in which a third-party developer owns, operates, and maintains the PV system, and a customer agrees to purchase the system's electric output from the solar services provider for an agreed-upon price and for a predetermined period. The systems may be hosted on site, such as the customer’s roof, or at an off-site location.” –EPA*
- The RFP should bring together Utility Accounts and Solar Developers through an agreement to build and maintain solar and purchase the electricity generated.



*Renewable Energy Contract Development Best Practices

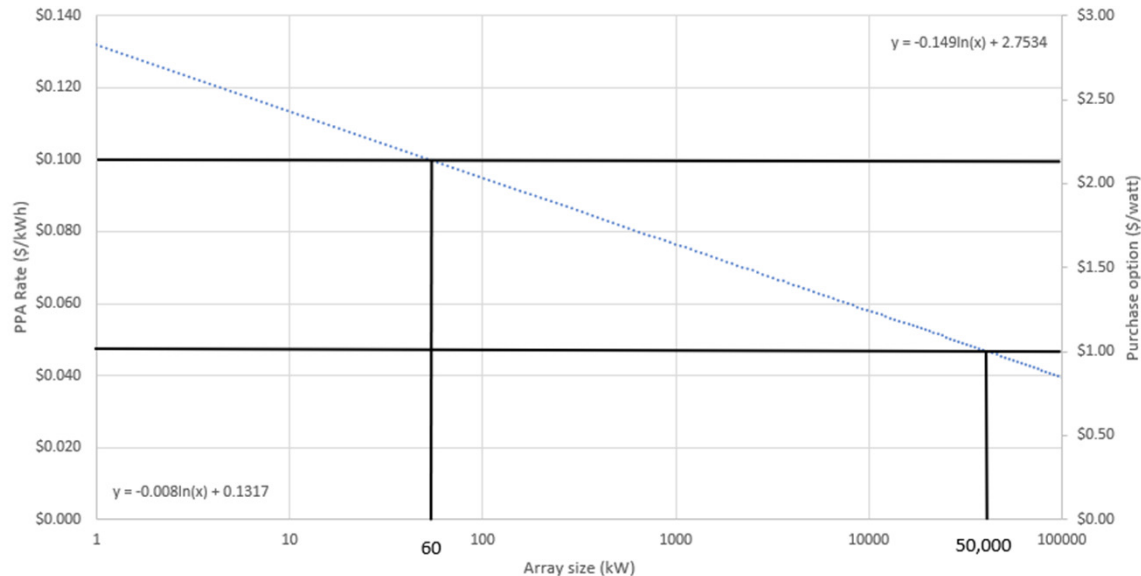
<https://www.epa.gov/repowertoolbox/renewable-energy-contract-development-best-practices>

Economics: Bigger = Better Pricing

- Pricing is variable: local site conditions, interconnection, developer/installer
- Incentives: Federal tax credit; State incentives exhausted currently
- Large project off-site PPA for ComEd/Ameren IDOT accounts: pricing range <\$0.05/kWh - \$0.075/kWh

□ lower end is very close to immediate savings, worth doing RFP

- Bundled small on-site project PPAs in rural coops and MidAmerican
 - PPA pricing <\$0.10/kWh □ immediate savings
 - Very small individual projects not cost-effective



Task 3 Decision Support Tool

Decision Support Tool

- Provide initial guidance on solar feasibility and sizing for IDOT sites
- Over 850 IDOT sites, with energy analysis derived from 350 IDOT electric accounts
 - Rest areas & welcome centers
 - Maintenance yards
 - Offices
 - Interchange ROW
 - Large ROW sites

Home

Office and Maintenance
Yard

Rest Area and Welcome
Center

Open Lands

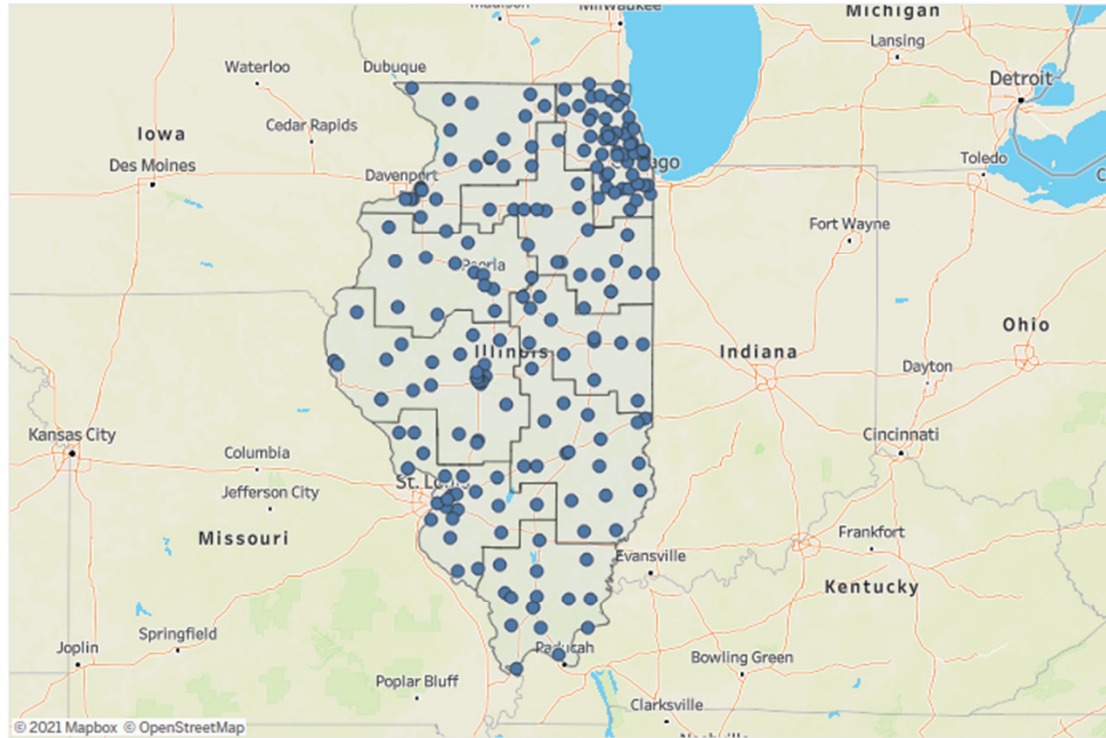
IDOT Interchanges

All Facilities

Suitability Map Viewer

Site Solar Index
Blue: Promising
Grey: Fair
Red: Poor

Office and Maintenance Yard



This map shows the locations of IDOT offices and maintenance yards. Rooftop solar on the office and maintenance buildings may be feasible at these sites. Click the dots for more detailed information about each site.

The Site Solar Index is rated as blue for all sites as these buildings are not typically shaded by trees.

- Blue (promising): Suitable for solar

Solar system details are determined by the loads (how much electricity is consumed on site). The system is sized to meet the estimated electrical load on site, and the system cost is estimated for a solar array of this size. A solar system can be sized smaller but not larger than what is needed by the electrical load on site. Actual sizing depends on the amount of suitable available space on a

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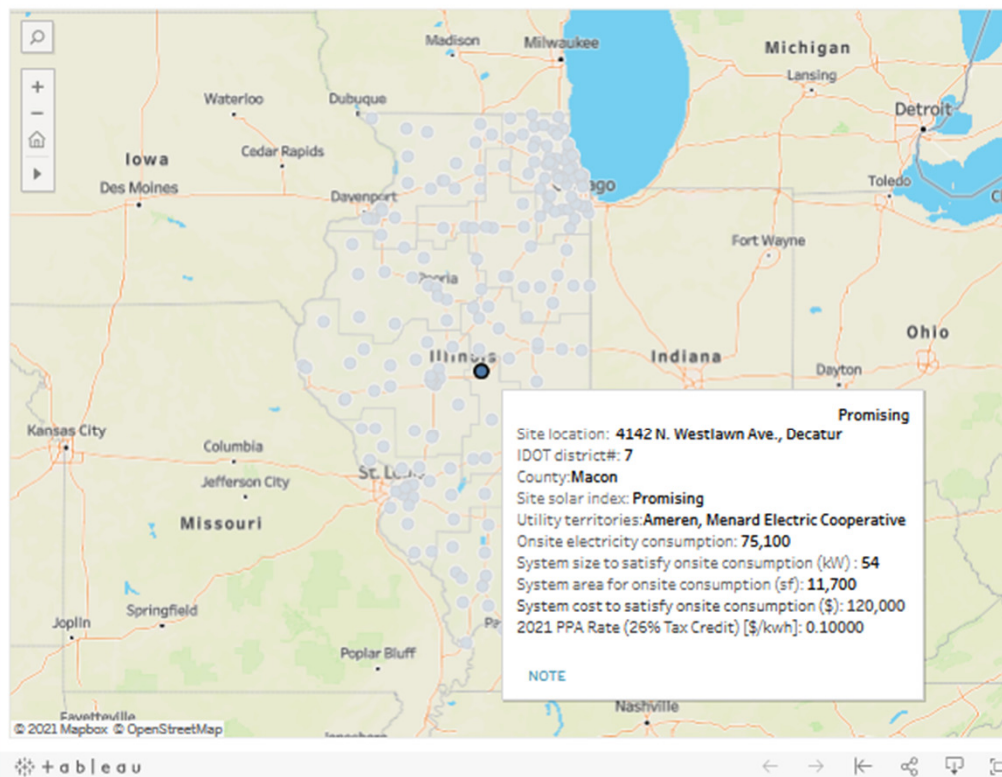
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Red: Poor



Office and Maintenance Yard



Promising
Site location: 4142 N. Westlawn Ave., Decatur
IDOT district#: 7
County: Macon
Site solar index: Promising
Utility territories: Ameren, Menard Electric Cooperative
Onsite electricity consumption: 75,100
System size to satisfy onsite consumption (kW): 54
System area for onsite consumption (sf): 11,700
System cost to satisfy onsite consumption (\$): 120,000
2021 PPA Rate (26% Tax Credit) \$/kwh: 0.10000

NOTE

This map shows the locations of IDOT offices and maintenance yards. Rooftop solar on the office and maintenance buildings may be feasible at these sites. Click the dots for more detailed information about each site.
The Site Solar Index is rated as blue for all sites as these buildings are not typically shaded by trees.
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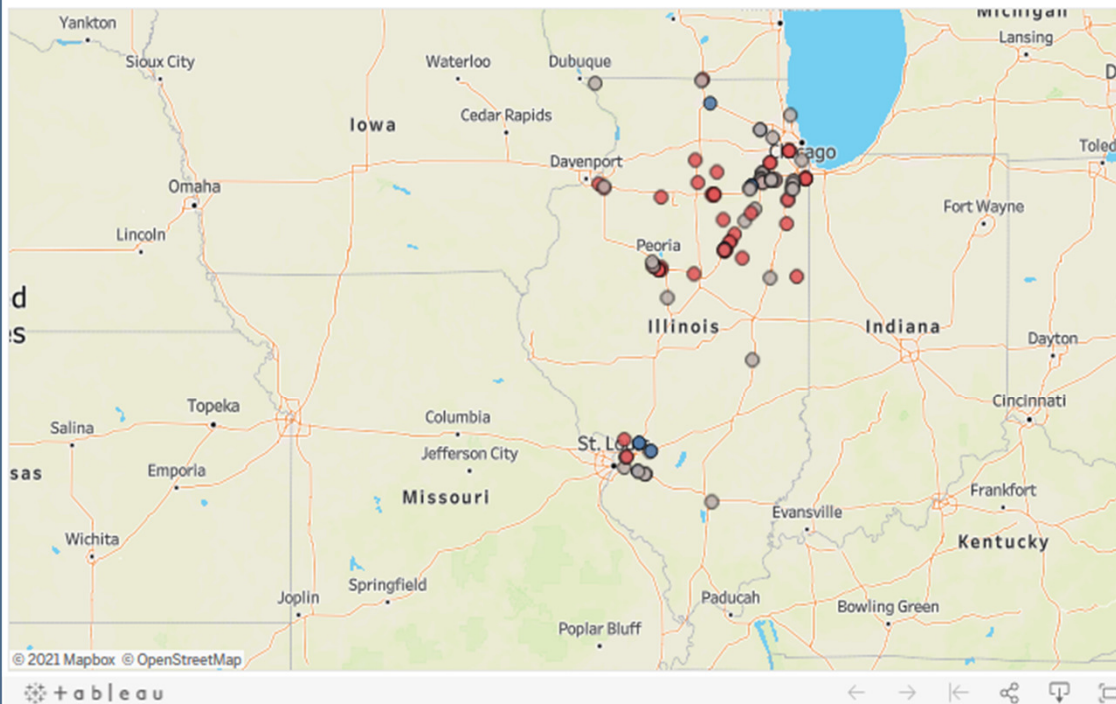
IDOT Interchanges

All Facilities

Suitability Map Viewer



Open Lands



This map shows the locations of IDOT open lands. A larger ground-mounted solar array may be developed on these open lands. The colors of the dots indicate that the site has promising suitability (blue), fair suitability (gray), or poor suitability (red).

Site Solar Index is based on the amount of land available. Solar feasibility on open lands is impacted by their ability to utilize economies of scale. Open lands do not have onsite loads and are only cost effective if they are large enough to utilize economies of scale.

- Blue (promising): 20+ acres
- Gray (fair): 5-19 acres

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Suitability Map Viewer

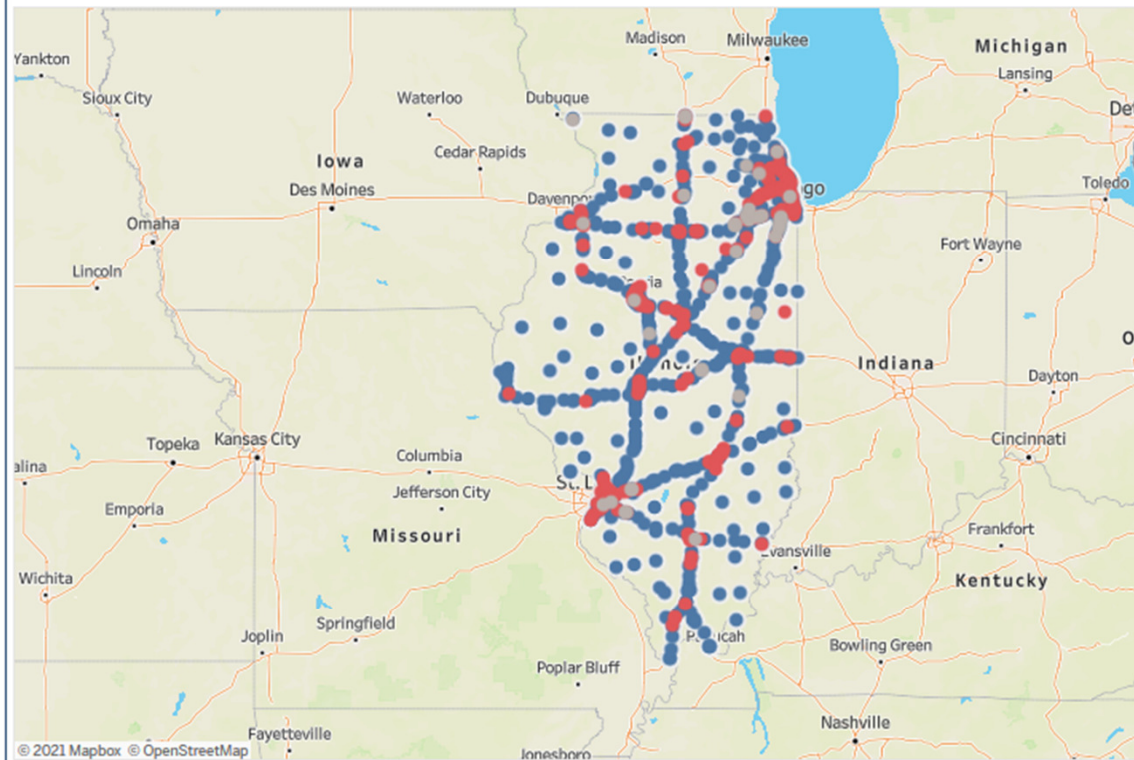
Site Solar Index

Blue: Promising

Grey: Fair

Red: Poor

All facilities



This map shows the locations of IDOT facilities and lands. This includes offices and maintenance yards, rest areas and welcome centers, open lands, and IDOT interchanges. Feasibility is best when the solar system can either be connected to a lighting system or other significant electrical load located on site or of a large enough scale to take advantage of economies of scale. Each category of locations may be found in its own map for easier viewing. The colors of the dots indicate that the site has promising suitability (blue), fair suitability (gray), or poor suitability (red). Click the dots for more detailed information about each site. Refer to the individual maps for more detailed descriptors.

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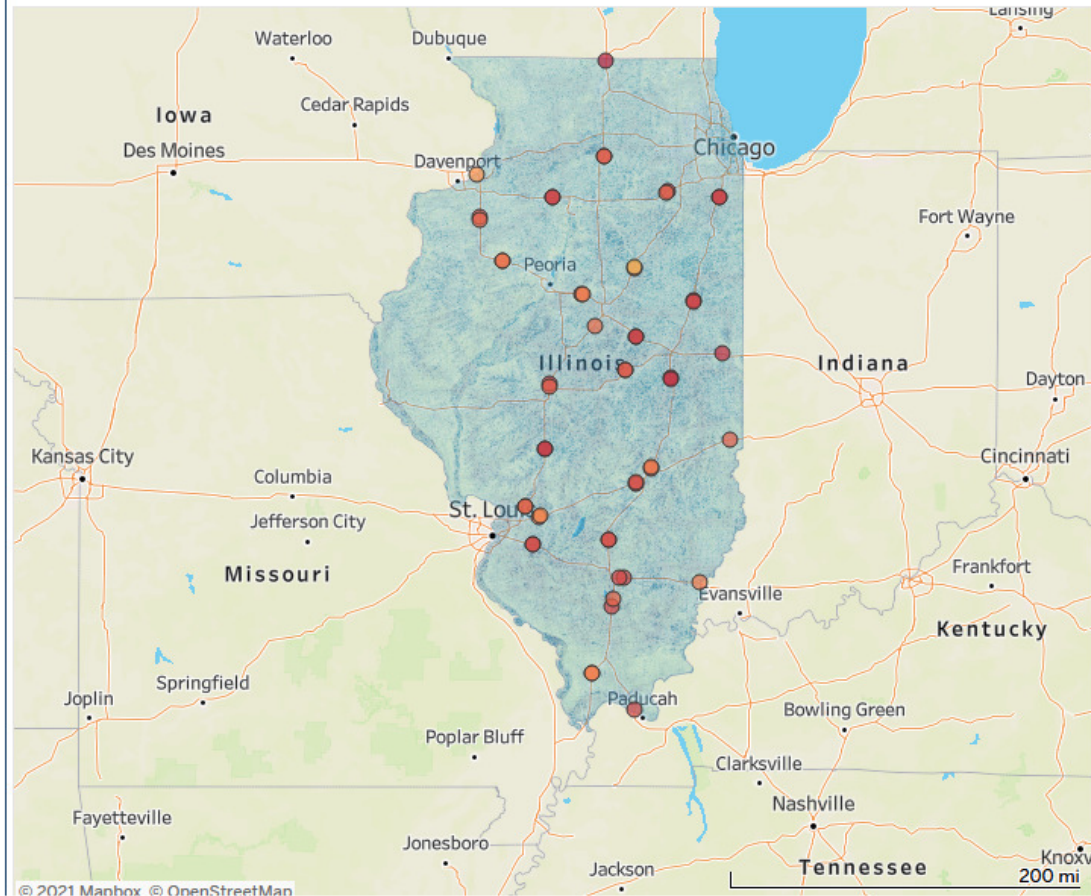
Open Lands

IDOT Interchanges

All Facilities

Suitability Map Viewer

Suitability — Rest Area



Suitability
1.810 4.399

IDOT Rest Area Suitability
0.000 3.800

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Center

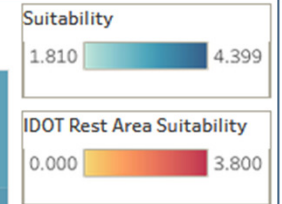
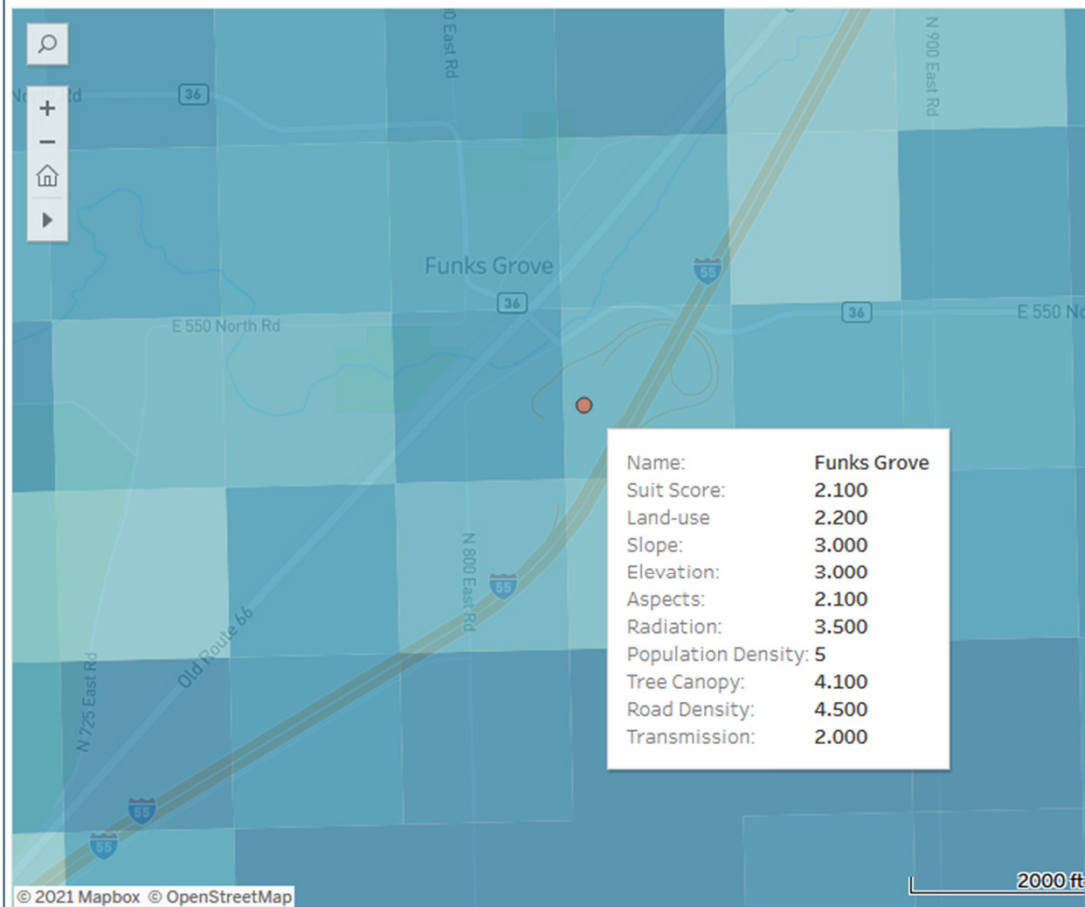
Open Lands

IDOT Interchanges

All Facilities

Suitability Map Viewer

Suitability — Rest Area



Creating Project Bundles

- Using the tool to identify sites for bundling small projects
 - Rural coops
 - Small projects, mostly 10 kW or smaller
 - Geographic clusters

Recommended IDOT Solar Strategy

IDOT Solar Implementation Strategy

1. Large solar project to supply electricity to IDOT's accounts in ComEd/Ameren
 - I-80 at Minooka and/or I-255&IL-62 east of Granite City
 - Power purchase agreement (PPA), 25 year
 - ~70%* of electricity to IDOT electric accounts in ComEd/Ameren
 - ~16,000,000 kWh/yr ☐ ~11 MW installed capacity ☐ 50-70 acres
 - Anticipated pricing response: <\$0.05-\$0.075/kWh
- ALTERNATIVE: State agency collaboration for bigger project and better pricing
 - IDNR moving forward with RFP development
 - IDOC potentially interested

*Sizing the solar project at 70%, as opposed to 100%, of ComEd/Ameren electricity is suggested to allow room for energy efficiency improvements



IDOT Solar Implementation Strategy

2. Small project bundles to supply electricity to IDOT's accounts in rural coops
 - Bundled projects for better pricing
 - Higher electricity cost in rural coops → easier for small solar to cost compete
 - Use decision support tool for site identification
 - PPA recommended
 - Net metering limits in coops → ~10-20 kW solar per site

Contacts for follow up:

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